PB-217 479

QUARTERLY PROGRESS REPORT, OCTOBER 1-DECEMBER 31, 1969

Federal Water Pollution Control Administration
Corvallis, Oregon

January 1970

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QUARTERLY PROGRESS REPORT

PACIFIC NORTHWEST WATER LABORATORY CORVALLIS, OREGON

OCTOBER 1–DECEMBER 31, 1969

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FEDERAL WATER POLLUTION
CONTROL ADMINISTRATION
NORTHWEST REGION

CLEAN WATER

47

PACIFIC NORTHWEST WATER LABORATORY

QUARTERLY REPORT

October 1 through December 31, 1969

United States Department of the Interior
Federal Water Pollution Control Administration
Northwest Region, Corvallis, Oregon

January 1970

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OFFICE OF THE LABORATORY DIRECTOR

Dr. Bartsch presented the keynote address "Water Pollution--An Ecological Perspective" at Session 4 of the 42nd Annual Conference of the Water Pollution Control Federation, Oct. 5-10, 1969, in Dallas, Texas.

Dr. Bartsch presented a talk entitled "People, Water--And Problems" at the Willamette Valley Environmental Conference, Oct 31-Nov. 1, 1969, in Salem.

On December 9, 1969 Dr. Bartsch attended the 1200 Series Program Reviews in Washington, D.C.

Dr. Bartsch attended a meeting of the Project Advisory Committee to the Inland Lakes Renewal and Management Project, in Madison, Wisconsin, on Dec. 11.

Dr. Bartsch participated in the Hearings of the Conservation and Natural Resources Subcommittee of the House Committee on Government Operations held in Washington, D.C., Dec. 15-16, 1969.

Dr. Bartsch presented a talk "Ecology: An Old Word with New Meaning?" at the Regional SCOPE Seminar held at Portland, Oregon, Dec. 30, 1969.

NATIONAL COASTAL POLLUTION RESEARCH PROGRAM

910101/1607

Status of Projects and Significant Accomplishments

Reaeration

One run was made in the quarter in the series aimed at measuring reaeration rates for various conditions in the Yaquina estuary.

The machine shop work on an *in situ* radioactivity counter has been temporarily discontinued due to budget limitations. No further field work is scheduled for this project until more radioactive supplies and equipment can be procured.

Analysis of Dredge Spoils and Other Coastal Wastes

Bids for a pulse height analyzer for analysis of trace metals in coastal wastes and sediments have not yet been obtained. Meanwhile a literature review of trace materials in coastal waste disposal judged to be significant for probable mechanisms and fates of these trace materials has been initiated. No benthic respirometry was done during the quarter.

Kraft Mill Outfall Plumes

Work in effluent plume tracing by the fluorometric procedure previously developed continued in this quarter. In one instance this method and an airborne sensor method (two-color photography) were

tried;correlation between the two methods will be made when the airborne data are available. The aim is to use the chemical method as a base to calibrate the airborne sensor which can oversee the entire plume more easily than a small boat ocean-sampling excursion.

The kraft mill effluent fluorometric procedure is being assembled into a report.

NAS - NAE State of the Art Report

A report entitled "Management of Wastes in the Coastal Environment" was prepared by Coastal Pollution Research Program personnel. It contained recommendations for research on physical, chemical, and biological aspects in the coastal environment. It was published in the National Estuarine Study Report.

Columbia River Estuary Temperature Model

Part I of the final project report was completed, reviewed, and revised. Part I consists of a discussion of theory, computer programs, and program notes. Part II, a discussion of input-output and model verification, was begun.

Programs employed by the U. S. Navy Fleet Numerical Weather Central for calculation of coastal currents were examined with an eye to their utilization in coastal and estuarine pollution problems.

Estuarine Diffusion of Pollutants

Approximately 90 per cent of the drafts for the state-of-the-art report on estuarine water quality modelling was received by TRACOR and duplicated for preliminary review. The second conference scheduled for mid-November 1969 was postponed again and tentatively scheduled for early 1970. Because of the large amount of material received, the time required for complete review will be longer than anticipated; the lack of a lead chapter also contributed to the setting back of the conference date.

Ocean Outfalls

State-of-the-art report number one is still being revised. This report covers the basic theoretical development of relationships necessary for the design of an outfall system. As suggested by several reviewers, much material of a theoretical nature was condensed and additional information on operational aspects of drift flow models was added. A computer program for one of the models considered for operational development was run on the IBM 360-65 with satisfactory results. Further development will be postponed until the revision of the report is complete.

Design of Barge Disposal Systems

A rough draft of the state-of-the-art report on barge waste disposal systems is near completion.

A programmed analysis for describing the fate of debris from an underwater explosion has been received and is being studied for application in the analysis of slug releases from barges.

Equipment and Instrumentation

Bidder qualification statements from 28 firms were received in response to the Request for Proposal on development and demonstration of equipment and methodology for tracing solids discharged to the marine environment. These have been reviewed and 19 were selected to submit proposals. This is now at headquarters awaiting further action.

Grant and Contract Research

Technical reviews were provided on applications and proposals for research grants and contracts related to the following subjects:

1. A Proposal to Establish and Operate an Estuarine and Coastal Zone Bibliographic Indexing System and Service - preproposal.
2. Water Pollution Research by Use of Mathematical Modelling - 16050 FEF.
3. Design of Ocean Outfalls Against Wave Effects - 16070 FEA.
4. Demonstration of Pollutant Transport, Fate, and Geochemical Interaction in the Coastal Littoral Current of Georgia - 16070 FLT.
5. Coastal Pollution - Literature Search, Indexing, and Abstracting - 16070 FJV.
6. The Components of Oxygenation in Estuaries - 16070 FJC.

7. A Proposal for Development and Evaluation of a Prototype Water Temperature Measurement System for Large Estuary Areas - 16070 FJI.

8. Research and Development Study for Estuarine Data Management using Hybrid Computer Techniques - 16090 FEB.

Plans for Third Quarter, FY 1970

Work will continue on review of information available on trace materials in sewage wastes, their fate in coastal waters and sediments, and possible mechanisms by which they interact with other constituents in the coastal environment.

Work on a report on kraft mill effluent tracing will be continued.

Work on a report describing the method of trawl sampling and examples of available data from Yaquina Bay studies will continue.

Part I of the user's manual of the Columbia River estuary temperature model will be be published; part II will be completed and distributed for review.

The second conference on the state-of-the-art of estuarine water quality modelling will be held, and the final report reviewed internally.

The Geodyne current-conductivity-temperature-depth system will be calibrated and field tested. The instrument will be used as an aid in verifying numerical models of offshore currents and dispersion.

Preliminary testing of a U.S. Navy Fleet Numerical Weather Central model will be undertaken.

NATIONAL EUTROPHICATION RESEARCH PROGRAM

910101/1601 and 910102/1601

General

Dr. Bartsch participated in a panel discussion "Eutrophication--Causes, Effects, and Control" at the Indiana Water Pollution Control Association annual meeting in Indianapolis on Nov. 18, 1969.

Dr. Bartsch and Mr. Byram participated in the Eutrophication Workshop, jointly sponsored by the FWPCA and the University of Florida, in St. Petersburg, Nov. 19-21, 1969.

Dr. Bartsch attended a meeting of the Joint Industry/Government Task Force on Eutrophication, in Madison, Wisconsin, Nov. 24-25, 1969.

T.E. Maloney visited a demonstration grant project on the Eutrophication of Surface Waters of Lake Tahoe and Indian Creek Reservoir, and Dr. Goldman's Research Grant Project on the Limnology of Lake Tahoe. Mr. Maloney also visited Dr. Jackson at Syracuse University to discuss and observe the pilot plant project on viral control of blue-green algae. Messrs. Maloney and Miller met at Cincinnati with cooperators who are evaluating the Provisional Algal Assay Procedure to discuss their research findings.

Dr. Bartsch attended a special meeting for government representatives of the Joint Industry/Government Task Force on Eutrophication held in Cincinnati, Ohio, Dec. 8, 1969.

T.E. Maloney was available as a technical resource in Washington, D.C. for FWPCA witness before the Conservation and Natural Resources Subcommittee of the House Committee on Government Operations.

Mr. Maloney met with Dr. Sanders and Dr. Kerr at the Southwest Water Laboratory to discuss their work with algal physiology and nutrition.

NERP personnel were visited by Mr. Michael Martin, Director of Parks and Recreation for the City of Albany, Oregon, with respect to the city's desire to improve Waverly, Swan, and Timberlinn Lakes. Local service organizations are interested in participating financially, and they have contemplated aeration of Waverly. We foresee possibilities of using these lakes in an experimental capacity, and have agreed to conduct a brief limnological exploration in January 1970, results of which will determine future procedures.

Meetings were held at the Regional Office in November relative to future studies of Waldo Lake. PNWL was represented by Messrs. Bartsch, Powers, Malueg, and Tilstra. Other organizations represented were the U. S. Forest Service, Oregon Department of Environmental Quality, Oregon Game Commission and the Oregon Department of Health. It was agreed that the unusually pristine condition of Waldo Lake merits special management consideration. PNWL was made coordinator of studies to determine existing and potential sources of contamination and optimum ways to manage the lake system.

PHYSIOLOGICAL CONTROL BRANCH

Status of Projects and Significant Accomplishments

Algal Assay Procedures Section

The evaluation of Selenastrum capricornutum as a test organism for both batch and continuous-flow assay systems was continued. The Shagawa Lake, Minnesota, series of tests continued with emphasis on the addition of phosphorus spikes to Shagawa Lake and Burntside River samples. The latter is the main tributary to Shagawa Lake. An addition of 0.02 mg/l P to these samples resulted in considerable increase in algal growth.

The first series of tests using depth-integrated (surface to four meters in meter intervals) samples from Cline's Pond were conducted. The seven-day algal growth responses had extremely good correlation with the nutritional contents.

"Bottle Test" assays were conducted to determine the effect of varying carbon concentration (as $NaHCO_3$) in Mod V algal culture medium. The latter is the Provisional Algal Assay Procedure (PAAP) medium with the total nitrogen (as $NaNO_3$) reduced to 1.5 mg N/l, the total phosphorus (as K_2HPO_4) reduced to 0.1 mg P/l, the iron deleted, the trace elements deleted, and the $Na_2EDTA \cdot 2\ H_2O$ reduced to 1.0 mg/l. Carbon to nitrogen ratios of 0, 2, 4, 8 and 16 were employed. The results of these tests were erratic with extreme

variation between replicates. Additional studies were conducted and it was found that, by returning the iron to the medium, good replication in algal growth was obtained.

Aquatic Plant Control Section

Studies were initiated to attempt to isolate phycoviruses for the blue-green algae Microcystis aeruginosa and Anabaena flos-aquae. Water samples from sewage treatment plants, stabilization ponds, farm ponds and lakes have been screened, but thus far no viruses have been isolated. While some plates indicated inhibition of algal growth, it is felt that this was due to anti-algal metabolites produced by other microorganisms. Further tests will be conducted to confirm this assumption.

Attempts are being made to isolate the bacteria which appear to grow symbiotically with the blue-green algae. If isolation attempts are successful, effort will be made to find specific bacteriophages for these bacteria.

Grant and Contract Research

Technical reviews of preproposals and proposals for research grants, demonstration grants, and contracts were provided for the following subjects:

1. Development of Decision Criteria for Evaluating the Technological and Economic Effectiveness of Alternative Algal Bloom Management Methods.

2. Ecology and Physiology of Blue-Green Algae.

3. The Biological Control of Water Pollution.

4. Evaluation of Some Environmental Conditions Causing Algal Blooms.

5. Provisional Algal Assay Procedure.

Publications

Maloney, T.E. and A. F. Bartsch. "Research to Save America's Lakes," in Water 1969, Chemical Engineering Progress Symposium No. 97, Vol. 65, American Institute of Chemical Engineers.

Plans for Third Quarter, FY 1970

Continue PAAP evaluation.

Continue study of the effect of carbon on the growth of Selenastrum capricornutum.

Continue study of algal and bacterial viruses.

ECOLOGICAL CONTROL BRANCH

Status of Projects and Significant Accomplishments

Nutrient Control Section

The aeration experimental program at Cline's Pond was terminated at the end of October. Waldo Lake was visited in November but stormy conditions restricted sampling to a few shore stations. Data from both projects have been in the work-up stage during the remainder of the quarter.

In connection with the Lake Sallie project, fish from that lake were analyzed for C and N. Nutrient analysis continues for rooted aquatic plants. In addition, arrangements have been made for cooperation reporting on Lake Sallie research with Dr. Neel at the University of North Dakota. Part of the results of our Lake Sallie studies is incorporated in a report entitled "Evaluation Studies on Removal of Plant Nutrients from Sewage Effluents by Induced Soil Percolation," presently in manuscript form.

Rainfall sampling at the Pacific Northwest Water Laboratory site was resumed in November, utilizing a new all-glass sampling device. Analyses are being made for N and P in the rainwater.

Experiments on phosphorus uptake by Elodea were initiated using ^{32}P. Algal samples for these experiments are collected from the Smith Loop area near Corvallis. Also, algae are being grown in a thermally stratified column for determining the movement of phosphorus through a thermocline using ^{32}P.

Sediment-Water Nutrient Interchange Section

Aluminum sulfate pellets added to an experimental pool in Upper Klamath Lake in August at a rate of 50 mg/l did not improve the water quality in any way over a two-month period. Standing crop of algae did not differ from the adjacent lake. This suggests several possibilities: the aluminum should have been added as a liquid; much more than 50 mg/l should have been added; or the aluminum should have been added before the onset of the Aphanizomenon bloom.

A trip was made to Vancouver Lake to obtain sediment samples in cooperation with personnel of Washington State University.

Laboratory experiments on sediment-water interchange and on nutrient inactivation have continued. Aluminum sulfate is less desirable in nutrient stripping than some other aluminum compounds because of the resultant tendency to form hydrogen sulfide. In interchange tests, algae was shown to grow better in the presence of sediment containing higher concentrations of soluble P and ammonia, than in the presence of sediment low in these nutrients.

Characterization of sediments from Shagawa Lake, Lake Herman, Lake Erie and Vancouver Lake has been a continuing part of the laboratory program.

Shagawa Lake Program

In situ assay experiments were terminated in early October owing to the onset of the northern Minnesota winter. A short-term cooperative program with the U. S. Forest Service to determine the feasibility of phosphorus removal from Shagawa Lake water was carried out utilizing the pilot plant. A decision has been made by headquarters to install a full-scale tertiary treatment plant to process the entire output of secondary sewage effluent from the city of Ely. Further evaluation of the biostimulatory characteristics of the Ely secondary effluent will be made through production of N-stripped effluent at the Shagawa Lake lab and the conduct of PAAP

tests on this effluent at PNWL. Clinoptilolite is being used as the N-removing agent. Data reduction and workup have been the principal occupation of the Ely staff apart from the above operations.

Grant and Contract Research

The following applications for research funding were reviewed by personnel of the Ecological Control Branch during the second quarter:

1. Control of Undesirable Aquatic Vegetation in Lake Taneycomo, Missouri.
2. Eutrophication in Relation to Agricultural Practice.
3. Effect of Sewage Effluents on Algae in Shagawa Lake, Minnesota.
4. Nutrient Dynamics in an Artificially Enriched Lake.
5. Nitrate Removal from Water at the Water-Mud Interface in Swamps, Marshes, and Flooded Soils.

Areas of Concern

The City of Ely appears to be making little progress toward funding necessary repair of the municipal sewage collection system. Headquarters has promised assistance in resolving the problems, but this has not materialized.

Manpower and budgetary shortages have resulted in greatly reduced progress in all areas of research including data workup and reporting.

Plans for Third Quarter, FY 1970

We will continue to push strongly for the establishment of full-scale lake restoration programs. The lake chain at Albany will be investigated with this in mind. Field work will otherwise be at a minimum, except for rainfall collection and one or two trips to Upper Klamath Lake. As much progress as possible will be made on reporting of results from Shagawa, Sallie, Upper Klamath, and Waldo Lakes, and from Cline's Pond.

WASTE TREATMENT RESEARCH & TECHNOLOGY PROGRAM

General

Dr. Bartsch and Mr. Boydston participated in a program review at headquarters for the 1200 series programs. Future program priorities were discussed.

PAPER & ALLIED PRODUCTS RESEARCH - 910101/1204

Status of Activities and Significant Accomplishments

Our inhouse cooperative work with Crown-Zellerbach, Lebanon project, has, for the past quarter, been principally concerned with the influence of phosphorus on sludge volume and settling, and microfermenter studies in series and parallel preparatory to series operation at Lebanon.

The Beloit-Passavant microsieve was to be delivered in December 1969. Delays have been encountered. In the meantime contacts have been made with the industry to determine interest in use of the equipment on a loan basis, in return for data collected on selected waste streams. In view of manpower restrictions, this may be our best avenue to worthwhile information with this equipment. Weyerhaeuser Co., Boise Cascade, Georgia-Pacific, Crown-Zellerbach Corp., and Publishers Paper have all evidenced interest and have suggested areas for experimental use.

Grant and Contract Research

The Crown-Zellerbach, Lebanon, R&D grant, earlier beset by many delaying difficulties, is now producing very worthwhile data. Progress on the R&D grant to OSU on Sphaerotilus studies has been delayed due to personnel changes. Dr. Pascha has left OSU and Dr. Anderson, Microbiology Department, is now principal investigator.

Grant administration and grant review occupied the majority of the period. Fundings are in progress for three additional R&D projects in PPB 1204. One of these projects is located in the Pacific Northwest Region.

Areas of Concern

The continued lack of resources prevents more than token effort on in-house studies and hampers adequate surveillance of ongoing grant projects.

Plans for Third Quarter, FY 1970

Continue grant monitoring and review.

Explore possibilities for loan of microsieve pilot plant unit to industry since resources limitations prevent in-house use.

We have received program approval for initiation of an in-house study to evaluate regrowth of coliform and fecal coliform in pulp and paper wastes. At the same time, the States of Oregon, Washington, and Idaho have requested the assistance of the Regional Office in

accomplishing similar work. Ultimately, this interest should extend to any high nutrient wastes such as those from potato and sugar processing. For the present, our interest will concern pulp and paper sources in Oregon and Washington. Selected primary and secondary systems will be sampled.

FOOD WASTE RESEARCH - 910101/1206

Status of Activities and Significant Accomplishments

A National Canners Association's (NCA) Research Highlights Program was attended. Discussions centered around current problems of the industry and NCA research plans for 1970.

Discussions were held with personnel from the Bureau of Commercial Fisheries and from Food, Chemical and Research Laboratories, Inc., regarding a grant application from the City of Kodiak, Alaska.

Both small-scale anaerobic trickling filters were operated throughout the quarter. Influent strength has varied from 2000 to 250 mg/l BOD as processing has shifted from corn to beets to carrots. The hydraulic load has been varied on both units in an attempt to increase the organic loading. Unit 1 which had an average detention time of 6.4 days reduced the BOD and SS by an average of 75 percent. Unit 2 with a detention time of 5.8 days reduced the BOD by 93 percent and the SS by 76 percent. The poorer performances of unit 1 is probably a result of a lack of feed due to pump problems for several days during the quarter. After resumption of feeding, the BOD removal dropped to less than 50 percent and a couple of weeks were necessary before reductions exceeded 90 percent.

Operation of the aerated lagoon pilot plant at the United Flav-R-Pac Cannery in Salem, Oregon, continued throughout the quarter. The hydraulic loading was increased stepwise such that the liquid detention was reduced from 10 days to 3.7 days. With the influent BOD concentration varying from 260 to 1400 mg/l, the loading in lbs BOD/day/lb MLVSS varied from 0.1 to 1.0. Reduction in BOD ranged from 41 to over 95 percent with an average of 82 percent. Two weeks of results were well below average and this may have been due to the lack of sufficient inorganic nutrients. During that time the BOD:N:P ratio was less than 100:2:0.6. Very little useful data was collected on the second pilot plant located at the Salem cannery. The Rotating Biological Contactor (RBC) unit was plagued with operational problems. The principal problem was the almost continuous failure of shear pins which connect the shaft of the rotating discs to the drive shaft. Once they sheared the rotation of the discs would stop and the biological growth on the discs would slough. The pilot plant was finally shut down and modified so that larger shear pins could be used. If time is available, next quarter the unit will be started again.

Plans were initiated for a three-day symposium on R&D work in food waste treatment. Two days will be devoted principally to ongoing grants and the third day will be handled by the Agriculture Research Service, USDA; other sponsors include the National Canners Association and the Western Frozen Food Association.

Grant and Contract Research

The following grant proposals and preproposals were received for review:

1. Demonstration of a Process for Economically Converting Sea Food Plant Waste to By-Products.
2. By-Product Recovery from Sweet Whey Processing Wastes.
3. Optimization of Bakery Wastewater Treatment.
4. Water and Waste Management in Sweet Potato Processing.
5. Activated Sludge-Bio-Disc Treatment of Distillery Wastes.
6. Pollution Control Program--Aroostook River and Prestile Stream, Coordinated Municipal-Industrial Approach.
7. Dry-Caustic Peeling of Tree Fruit.

During the quarter the following grants were awarded:

1. Reduction of Salt Content of Food Processing Liquid Waste Effluent, National Canners Association, Berkeley, California, FWPCA Grant - $64,382. Total Project Cost - $94,208.
2. A Method of Manure Disposal for a Beef Packing Operation, Illinois Packing Co., Chicago, Illinois, FWPCA Grant - $93,400; Total Project Cost - $156,000.
3. Elimination of Water Pollution by Packing House Animal Paunch and Blood, Beefland International, Inc., Council Bluffs, Iowa, FWPCA Grant - $161,398. Total Project Cost - $367,870.

4. Winery Wastewater--Characterization and Treatment, Widmer's Wine Cellars, Inc., Naples, New York. FWPCA Grant - $148,000. Total Project Cost - $284,000.

5. Vermont Cheese Industry Pollution Abatement Project, State of Vermont. FWPCA Grant - $823,120. Total Project Cost - $3,700,000.

These grants bring the total number to 45 in the PPB 1206 area. Of these, 36 are in the assigned area of responsibility of the Food Waste Research Branch. The 36 have a total estimated project cost of over $18,700,000 with FWPCA grant monies of over $6,300,000.

Current status of grants which have been assigned (project officer) to the Food Waste Research Branch is as follows:

1. 12060 EHS. "Cannery Waste Treatment by Lagoons and Oxidation Ditch," Melbourne Water Science Institute, Melbourne, Victoria, Australia. Vegetable and fruit wastes are being treated in two anaerobic lagoons followed by an oxidation ditch. Various organic loadings are being investigated along with varying BOD:N ratios in the influent.

2. 12060 EHV. "Aerobic Secondary Treatment of Potato Processing Wastes with Mechanical Aeration," The R. T. French Co., Shelley, Idaho. Following the correction of many mechanical, electrical, etc. problems, the system is finally functioning properly. Even though the BOD load is near 27,000 lbs/day compared to a design value of 14,200 lbs/day, the BOD is currently being reduced by 92 to 96 percent.

3. 12060 FAD. "Pollution Prevention by Aeration of Fruit Processing Wastes," Snokist Growers, Yakima, Washington. The final report has been reproduced and forwarded to headquarters for distribution.

4. 12060 DSI. "State of Art, Sugarbeet Processing Waste Treatment," Beet Sugar Development Foundation, Fort Collins, Colorado. Some onsite visits were made and work has started on the first draft of the final report.

5. 12060 ECF. "Water Pollution Abatement in the United States Seafood Industry: State of the Art," Oregon State University, Corvallis, Oregon. The first draft of the final report is nearly complete.

6. 11060 EZR. "Complete Aerobic Treatment of Combined Domestic and Industrial Wastes with Mechanical Aeration," City of Dallas, Oregon. A revised testing program was completed and the schedule was followed during the quarter. The influent BOD has dropped from a monthly average of 310 for September to about 100 for December. This is a result of increased infiltration and the termination of processing at the cannery. Throughout this period the effluent BOD and SS has averaged less than 10 mg/l.

7. 12060 EIG. "Full-Scale Demonstration and Evaluation of Potato Dry and Wet Caustic Peeling Processes," Western Potato Service,

Inc., Grand Forks, North Dakota. Sampling and analyses plans have been completed for both processing plants. Nearly all the equipment has been installed for conversion of the Grand Forks plant to the "dry caustic" peel.

8. WPD 93-04-68. "Anaerobic-Aerobic Sugar Beet Waste Treatment," Beet Sugar Development Foundation, Fort Collins, Colorado. The first draft of the final report is still in preparation.

9. WP-01486-01. "Status and Research Needs for Potato Waste Waters," University of Washington, Seattle, Washington. The final report has been sent to the printer for reproduction.

Drafts of final reports have been reviewed for the following grants in addition to those for numbers 3 and 9 above.

1. Improvements of Treatment of Food Industry, RAI Research Corp., Long Island City, New York.

2. Use of Fungi Imperfecti in Waste Control, North Star R&D Institute, Minneapolis, Minnesota.

Areas of Concern

Grant monitoring continues to suffer due to a lack of manpower and money.

Plans for Third Quarter, FY 1970

1. Continue grant monitoring and reviewing.
2. Continue pilot plants until processing stops.
3. Complete planning for three-day symposium.

REGIONAL RESEARCH STUDIES - 910101/1208

Status of Projects and Significant Accomplishments

Aerated Lagoon Treatment of Food Processing Wastes

The final report "Secondary Treatment of Potato Processing Waste" has been published and distributed, and this project is officially closed.

Waste Treatment at Recreational Areas, Project No. 0970-208-11

The working paper on evaluation of extended aeration treatment at recreation areas has been submitted for publication. The final report is in draft form and is receiving preliminary review.

Log Handling and Storage, Project No. 0970-208-12

All field and laboratory work has been completed and data is being evaluated. Work has started on a draft of the final report.

Animal Feedlot Waste Disposal, Project No. 0970-208-15

Meetings have been held with various state cattlemen's associations, and all have promised maximum cooperation in connection with this study. Cooperation in obtaining state inventories of cattle feedlots is also being obtained from the U. S. Department of Agriculture State Statisticians, for a fee. The project proposal has been prepared and reviewed, and work is progressing.

Other Activities

Work is progressing on the evaluation of biological pilot plant treatment of steam vat condensates in plywood plants, and report preparation is in progress.

Collection of data to serve as the basis for a regional pesticide status report has now been completed, and is being sorted. Generally it reveals that many agencies are involved, but few have well developed or coordinated programs.

Personnel are being provided to Food Wastes Research and Paper and Allied Products Research to support the total research program in those areas.

Grant and Contract Research

A draft of the final report on Storm and Combined Sewer Contract 14-12-128 was submitted and reviewed. It has been sent, with comments, to the Contracting Officer for submission to the contractor.

Areas of Concern

Due to limited funds and positions in the Food Wastes and Paper and Allied Products Research areas, these areas are receiving personnel support from Regional Research Studies. Fund limitations have necessitated reductions of temporary employees and eliminated all but the most critical expenditures for travel and supplies. The recently acquired Laboratory trailer cannot presently be utilized due to lack of funds for needed equipment and supplies. Publication of reports will be held to a minimum number because of the lack of funds.

Reports and Papers

A draft of the Pilot Plant Treatment of Steam Vat Condensates in Plywood Plants is being prepared.

The working paper on Evaluation of Extended Aeration Treatment at Recreation Areas has been submitted for publication.

The final report on aerated lagoon treatment of food processing wastes has been published and distributed. It is "Secondary Treatment of Potato Processing Wastes."

Plans for Third Quarter, FY 1970

Waste Treatment at Recreation Areas, Project No. 0969-208-11

The final report will be revised and reviewed. Completion of this project and report is now estimated at 1 June 1970.

Log Handling and Storage, Project No. 0969-208-12

Draft of final report will be completed.

Animal Feedlot Waste Disposal, Project No. 0970-208-15

Inventory of feedlots will be completed, and limited field studies will be initiated.

Other

The regional pesticide status report will be completed.

The report on Steam Vat Condensate Treatment will be nearing completion.

As projects are completed, new projects will be developed within existing personnel and budgetary limitations.

NATIONAL THERMAL POLLUTION RESEARCH PROGRAM

910101/1613

Status of Projects and Significant Accomplishments

Consultation and Advisory Services

Comments were provided the Northwest Region on a draft, "Basic Data Needs for Thermal Power Plant Site Evaluation," re. Washington Water Quality Standards. Also, Mr. Rainwater and Dr. Tichenor met with Dr. Zeller of the Northwest Region to discuss pre-siting surveys for future power plants within the Region.

Technical assistance was provided the Southeast Region in the form of a digest of the status of technology relative to the Turkey Point nuclear power station. We also supplied the Southeast Region with computations of energy budget parameters.

Information was furnished the Assistant Director for Engineering, headquarters, on research topics for improved water pollution technology in the Great Lakes -- "Suggestions for Research Plan for the Great Lakes;" re. Section 15, H. R. 4148.

Computations on cooling pond performance and evaporation losses were provided the River Basins Planning Branch at headquarters; aiso supplied was information on North Anna Power Station, Virginia.

Information on calculating incoming short-wave solar radiation was furnished the Systems Analysis and Economics Branch, Division of Technical Control, headquarters.

Effects of Temperature on Fresh and Marine Fish Species

See Biological Effects Research Program report, page 34.

Engineering and Cost Aspects of Heat Dissipation

Working Paper #67, "Economic Aspects of Thermal Pollution Control in the Electric Power Industry," was completed and distributed to all Regions, Laboratories and individuals in headquarters.

A computer program for predicting performance of natural draft cooling towers was put on FWPCA IBM System 360 in headquarters.

Final draft of a working paper, "A Method for Predicting the Performance of Natural Draft Cooling Towers," was completed.

General

While attending the ASCE Meeting, October 14-17, Dr. Tichenor participated in a meeting of the Committee on Thermal Power, Sanitary Engineering Division, ASCE, on October 15.

On October 22, Mr. Rainwater attended a meeting called by the Commissioner to consider policy relative to thermal pollution control. Two staff papers were prepared concerning the nationwide feasibility of cooling towers and cooling ponds.

Mr. Wallace Allen and Mr. Russell Miner, engineers with PG&E in San Francisco, visited with NTPRP staff to obtain technical information which would be helpful in their model development, as they are

in the process of developing temperature prediction techniques for the Sacramento Delta area, using both physical and mathematical models. Also present was Mr. Phil Woods, representing the Southwest Region.

Dr. Bartsch presented an address "Thermal Effects on Ecological Systems" at the Northwest Conference on the Role of Nuclear Energy, Dec. 4-5, 1969, in Portland, Oregon.

In October Mr. Rainwater gave a talk to the Northwest Water Supply and Pollution Control Commission on the subject, "Temperature Controls in Thermal Power Development."

On November 19, Mr. Rainwater participated as a panelist on the program of the National ASME Meeting in Los Angeles -- Open Forum on Heat Dissipation.

Mr. Rainwater appeared on Channel 7 television, November 21, to discuss the thermal pollution problem.

Dr. Shirazi spent ten days at Colorado State University to perform the initial phase of a joint research project with U. S. Geological Survey.

Grant and Contract Research

NTPRP commented to the TVA on a proposal for installation of a catfish farming facility adjacent to the Gallatin Steam Plant, Gallatin, Tennessee.

An inquiry from Washington Environmental Council on power plant siting and thermal pollution control was reviewed.

Messrs. Rainwater, Tichenor, Christianson, and Winiarski met with Dynatech personnel to review results of the second phase of the Dynatech contract.

Dr. Shirazi was visited by Dr. Kch, Tetra Tech Corp., to discuss and outline the direction of our contract with them on studies of thermal outfalls.

The final report of our contract with Water Resources Engineers, "Formulation of a General Mathematical Model for the Prediction of Thermal Energy Changes in Impoundments," was received.

Headquarters began contract negotiation for a study on the economic analysis of thermal pollution abatement costs in the electric power industry.

Technical reviews of proposals for research grants, demonstration grants and contracts were provided for the following subjects:

1. Liquid nitrogen cooled condenser in power plants.

2. Experimental investigation of spray system for atmospheric heat dissipation.

3. The closed cycle gas turbine as a thermal pollution control measure.

4. The feasibility of developing an advanced power generating system free of atmospheric and thermal pollution.

5. Thermal pollution.

6. A suggested program for the control of water thermal pollution from large power plants employing advanced cooling tower technology.

7. Future power system evolution.

Mathematical model for thermal response.

8. Proposal to raise catfish at TVA's Gallatin Steam Plant.

9. Thermal pollution control of plant effluents by "land cooling" method.

10. Project for concentrated research and training in hydrologic and hydraulic aspects of thermal pollution control (Continuation).

11. Thermal stratification and reservoir water quality (Continuation).

12. Effect of thermal pollution on ability of coho salmon to adapt to sea water.

13. Ecological changes in the Mississippi River.

14. Prediction and control of thermal pollution (Continuation).

15. Predicting water quality change in reservoirs using operators research techniques.

16. An experimental and analytical study of some basic heat and mass transfer problems related to thermal pollution.

17. Intensive production of animal protein by culture of fish in raceways supplied with warm water.

18. Analysis of engineering alternatives for environmental protection from thermal discharges.

19. Effects of diffusers on the mixing process at discharge outfalls.

Reports and Papers

Working Paper #67 on "Economic Aspects of Thermal Pollution Control in the Electric Power Industry," was completed and distributed.

A "canned" slide-illustrated talk on thermal pollution that other FWPCA personnel can give, or use as source material, was made available to all Regions and Laboratories of FWPCA.

Plans for Third Quarter, FY 1970

A paper by Drs. Ronald Garton and Ralph Harkins "Guidelines and Statistical Analysis of Biologic Data at Potential Sites of Heat Discharges," will be published.

Draft of a paper, "Reflective Cooling Ponds," is expected to be completed in January, 1970.

A working paper on the field study will be published.

"A Method for Predicting the Performance of Counterflow Natural Draft Cooling Towers," is in the process of being published as a working paper.

BIOLOGICAL EFFECTS RESEARCH PROGRAM

Status of Projects and Significant Accomplishments

Thermal Pollution Studies

1. Tissue Enzyme Studies:

This project area was reactivated recently and various tests and modifications of temperature regulation equipment were completed. Currently the equipment is functioning at acceptable levels.

The effects of temperature were determined relative to heart rates and body weightloss of jack coho salmon.

Tests for inactivation of enzymes *in vivo* were resumed and are proceeding according to plan.

2. Simulation of Adult Coho Salmon Migration Through Elevated Temperatures:

Adult and jack coho were collected from the spawning run into the Bonneville hatchery (Oregon Fish Commission) and were acclimated during a week to test temperatures of 50F, 62F, 68F (legal maximum), and 72F. Each test group contained about 25 jacks and 34 adults, and was exposed to the above temperatures for the time required to migrate between the ocean and Bonneville (9 days); thereafter all tanks were returned to 50F simulating entrance into natal streams for spawning. The experiment continued until all the fish had died or become sexually ripe and could be spawned.

The adult fish died quite rapidly at 72F (22.5C) and none survived to spawn. This portion of the experiment was repeated using only a 2.5-day exposure to 72F. The resulting mortality was less severe, but none of the females survived to spawn. Progressively lower test temperatures also had progressively higher survival and sexual ripeness was achieved in these test lots. Spawn was collected and its incubation is proceeding. Fertilization and hatching success are being evaluated.

The presence of fish diseases and the effects of elevated temperatures were examined but these data are not complete at this time. After the last fish was spawned, the Bonneville facility was dismantled or winterized and placed in storage.

The results of the study are being evaluated and a rough draft report will be available soon.

Waste Treatment Studies

Attempts to achieve natural spawning of adult coho were unsuccessful when they were held in an artificial spawning chamber. This chamber was about 3.5 feet wide by 7.5 feet long and was supplied with creek water at about 40 gpm. Coarse gravel was added to a depth of 6-8 inches and water depth was about 12 inches. Salmon placed in the creek spawned under similar conditions in one or two days. When sexually ripe salmon were placed in the chamber they dug redds but failed to deposit eggs in 10 days. Additional research will be

necessary before tests can be conducted in this manner on pollution effects to salmon spawning.

Several materials were used in tests for adverse effects to the fertilization of coho salmon eggs including kraft wastes, sulfite wastes, copper ions, ammonia, and pH. Incubation is proceeding but development of the embryos has been extremely slow due to the cold water.

Meetings

In November, Dr. Bouck attended a portion of the Annual Personnel Officers' Conference held in Kansas City, Missouri. At the request of Assistant Commissioner Grant, he participated in discussions being held regarding the new Career Development Plan for Professional, Scientific, and Engineering Personnel.

Grant and Contract Research

Personnel in the Biological Effects Branch continue to manage two research grants.

Areas of Concern

Facilities and quality and quantity of water supply continue to limit the productivity of the Biological Effects Research Program.

The studies on thermal effects to adult salmon have produced more questions than answers, partly because the facilities allowed

no replication of the tests and partly because this is a relatively unexplored area of research. At present, there are no plans to continue this research, but such plans should be developed and funded.

Considerable mortality has decreased the supply of coho salmon post-smolts and this may preclude their use in the tissue enzyme study. The cause of this mortality is unknown.

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1. Simulation of Adult Salmon Migration Through Elevated Temperatures and the Effects on Gametes and Progeny:

The main effort will be the analysis of data and development of a final report on this project.

2. Tissue Enzyme Studies:

In vivo effects of high but sublethal temperatures will be determined in as many species as possible.

3. Waste Treatment Studies:

Pending the results of this year's coho fertilization studies, various toxicants will be tested on steelhead spawn. Test facilities for conducting acute and chronic toxicity studies will be completed and utilized.

CONSOLIDATED LABORATORY SERVICES PROGRAM

Status of Projects and Significant Accomplishments

The backlog of analyses has been stabilized at approximately 1000+ determinations. A special technique was initiated to determine total phosphorus and total nitrogen of algae entrapped on three-micron Millipore filters. Replication of results has not yet been obtained. Efforts will continue to improve the technique.

The carbon and nitrogen in plant samples collected at Lake Sallie are being analyzed with the Hewlett Packard Carbon-Hydrogen-Nitrogen Analyzer.

Success is being achieved with the use of the Turner Model 210 Spectrofluorometer as an instrument capable of tracing Kraft liquor discharges in marine waters. An empirical method has been formulated using Kraft liquor from a specificmill as a standard and diluting this with sea water collected near but not under the influence of the mill. By establishing a standard series of dilutions with specific excitation and measurement for fluorescence, the concentration of Kraft liquor can be measured from grab samples collected in the vicinity of the mill discharge. In this manner, the flow pattern of the mill plume can be determined. The above study on fluorescence is closely coordinated with the National Coastal Pollution Research Program.

Automated Analytical Systems

A thermocouple has been installed in the digestion unit of the Technicon Kjeldahl digestor in an attempt to optimize temperature

conditions for digestion of samples. Good results have been obtained with standards using the Kjeldahl digestor. Because problems are still being experienced with recovery of spiked samples, Kjeldahl determinations will be made manually with the use of semi-micro Aminco technique until all problems are solved.

Gas Chromatographic Analysis

Pollution Surveillance samples are routinely being examined for chlorinated pesticides by the Portland laboratory. The Portland lab is now receiving fewer samples from oil spills than in the past.

Atomic Absorption Spectrophotometry

As of December 1, 1969, CLS is using preservative techniques and methodology specified in FWPCA Methods for Chemical Analysis of Water and Wastes, November 1969. Some minor changes in concentrations of preservatives were made. The major change attempted was the use of chelation of metals with ADPC and extraction of the chelate with MIBK. An unsuccessful attempt was made to set up standards with this procedure and attempts were made to try to recover spike additions without success. Analysis of individual metals (copper, zinc, iron, and lead) was attempted with success being achieved only for copper. At the end of December 1969, CLS is back to the concentration of metals by evaporation. The procedure of concentration by evaporation is less time-consuming and better recovery of spikes is achieved.

Biology

The log storage study is in the report writing phase. There is some backlog in examining plankton on Waldo Lake. Considerable effort is being expended on trying to concentrate plankton for enumeration and identification. The oligotrophic condition of Waldo Lake is presenting problems in quantifying and identifying the plankton.

General

CLSP suffered the loss of five temporary employees. Although its net loss was only three with subsequent transfers, the impact was felt and resulted in some effect on morale. The enthusiasm and work efforts of the remaining members of CLSP have overcome the transient loss of morale and productivity is again high.

Reports and Papers

A talk on Dissolved Oxygen Uptake of Dredge Materials was presented at the Annual Meeting of the Pacific Northwest Pollution Control Association. The talk will serve as a basis for a paper to be presented to the Journal Water Pollution Control Federation.

Equipment

CLSP is still awaiting approval for the use of no year funds to modify and update the carbonaceous analyzer. The gas partitioner has been repaired and will be put into operation.

Plans for Third Quarter, FY 1970

CLSP will work to resolve problems in the variability in membrane filters as to weight, total Kjeldahl nitrogen, and total phosphorus. The gas partitioner will be used for the analysis of gases dissolved in water and for the analysis of volatile acids in waste streams. Efforts will be continued in trying to reduce the backlog.

TRAINING AND MANPOWER DEVELOPMENT

910205/001

Status of Projects and Significant Accomplishments

Direct Training

"Basic Principles of Wastewater Treatment Operation" training course was presented in Anchorage, Alaska, October 13-17, for 34 students. The same course was presented at the Laboratory, November 17-21, for a total of 26 students.

"Freshwater Biology and Pollution Ecology" and "Membrane Filter Methods in Water Pollution Surveillance" training courses were presented in the Laboratory for 26 USGS students from December 8-19. These courses were planned and directed by the Cincinnati training staff, with the assistance of Laboratory Training staff.

The Regional Manpower and Training Director attended a national conference on operator training and a Regional Training Officers meeting in Atlanta, Georgia, during the quarter.

Cooperative Area Manpower Planning System

Visits have been made to Portland, Oregon, and Seattle, Washington, to monitor progress of their sewage treatment plant operator programs.

Approximately 120 manhours of teaching assistance was provided Linn-Benton Community College during the quarter.

Conferences were held with staff at Washington State University and at Green River Community College, Auburn, Washington, regarding sewage treatment plant operator training programs.

Public Relations

Tours and orientation were given for approximately 160 people during the quarter and the water pollution control films were loaned for viewing by approximately 800 people. Over 1,500 pieces of literature were distributed.

Plans for the Third Quarter, FY 70

"Sewage Treatment Facilities for Federal Installations" January 19-30, 1970.

"Chemical Analyses for Water Quality" March 2-13, 1970.